COPY FOR MR. J. ALLAN ROSS

HYDRO-ELECTRIC INQUIRY COMMISSION

ENGINEERING DATA

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

DESCRIPTION OF PLANT

WALTER J. FRANCIS & COMPANY

CONSULTING ENGINEERS

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

DESCRIPTION OF PLANT

Walter J. Francis.

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

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Walter J. Francis.

INDEX.

LIST OF ILLUSTRATIONS.

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

DESCRIPTION OF PLANT

Walter J. Francis.

Historical.

The original plant of The Ontario Power Company of Niagara Falls was designed by Messrs. P. N. and L. N. Nunn and was put into service immediately after its completion in 1905. The Company continued the operation of the plant until it became the property of the Hydro-Electric Power Commission of Ontario in 1917, since which period the plant has been operated by the Commission through its Operating Department.

The power house as originally laid out was built by successive stages, and the final addition was made in 1919.

General Description of the Plant.

Location.

The plant is located on the Canadian side of the Niagara River in the immediate vicinity of the Horseshoe Falls, the headworks being at the water's edge about a mile upstream from the Falls, and the power house, likewise at the water's edge, immediately below the Falls.

The general location and arrangement of the plant will be seen by reference to Drawing No. 1, being page 5 hereof.

The Headworks.

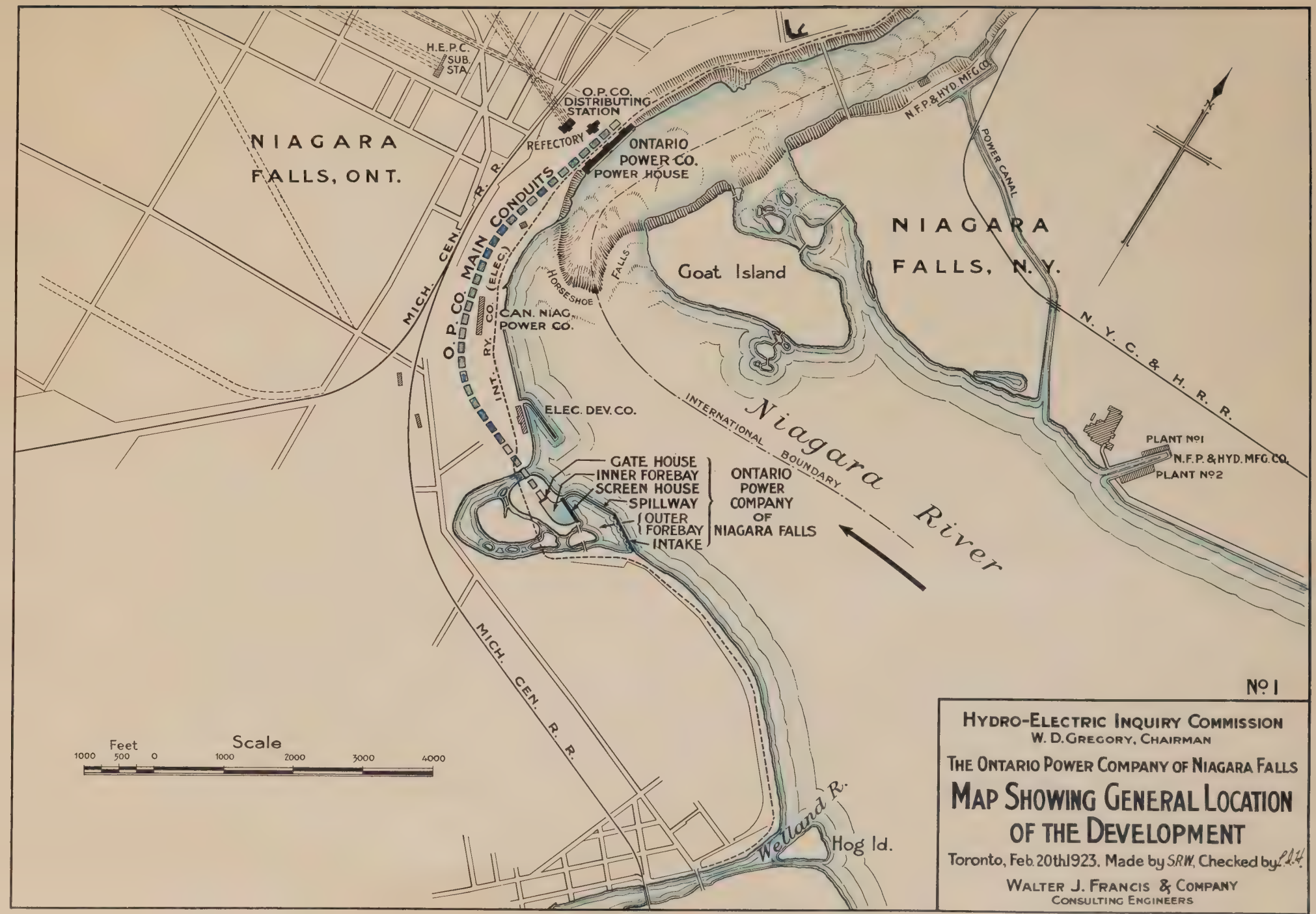
The headworks consists of an intake, an outer forebay, a screen house, an inner forebay and a gate house closely grouped together, and as a whole forming the entrance for the water to the main conduits conveying it to the power plant. All the structures of the headworks are of a permanent character, built of concrete, reinforced concrete and artificial stonework, the principal buildings being monumental in design.

The Conduits.

Three underground conduits convey the water from the headworks to the penstocks leading to the turbines in the power house. The conduits are approximately 6,500 feet in length. The alignment of the conduits is generally parallel to the shore, several hundred feet landwards, and is by curves of long radius, through a deflection of nearly ninety degrees to the right as one travels from the head-gates to the penstocks. The conduits have a total drop of 28 feet from the head-gates to the penstocks with a grade which is almost uniform.

The first of the conduits to be constructed was made of steel plate and is designated No. 1. It is the most westerly of the three, the general line of the conduits being in a northerly direction. This conduit is of

COPY



No 1

HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

MAP SHOWING GENERAL LOCATION OF THE DEVELOPMENT

Toronto, Feb. 20th 1923. Made by S.R.W. Checked by L.J.H.

WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS

circular section with an internal diameter of 18 feet.

The second conduit which was built is constructed of reinforced concrete, and is adjacent to conduit No. 1 and on the river side thereof. It is known as conduit No. 2. The section of conduit No. 2 is that described technically as a "hydrostatic chord", and has an area equivalent to that of a circle 18 feet in diameter. It was constructed in the years 1909 and 1910.

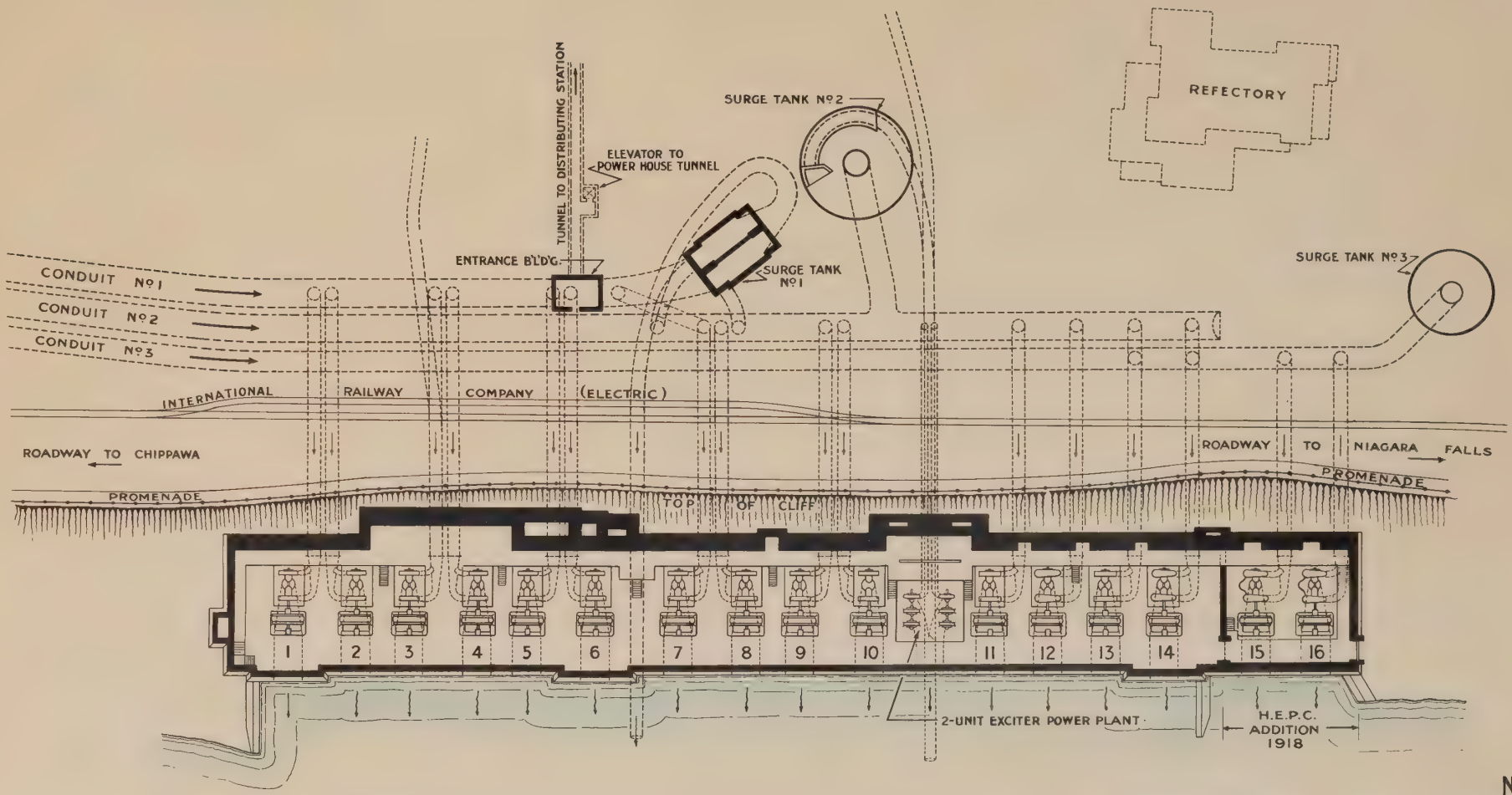
The third conduit, known as conduit No. 3, was completed in 1919. It is adjacent to No. 2 and on the river side thereof. It is a wood-stave conduit of circular section, measuring 13 feet 6 inches in internal diameter.

The water of the river is admitted to the conduits by means of Stoney sluice head-gates, there being one head-gate for each conduit, all located in the gate-house.

The Surge Tanks.

Three surge tanks, known as Nos. 1, 2 and 3, and located as shown on Drawing No. 2, being page 5 hereof, act as regulators on the main conduits. The connections of the surge tanks to the conduits will be seen by reference to Drawing No. 2.

Surge tank No. 1 was originally built in connection with conduit No. 1, while surge tank No. 2 was similarly constructed with conduit No. 2. Both are of monumental design. Surge tank No. 3 was constructed at the same time as conduit No. 3, and is an exposed steel tank 80 feet in diameter, of utilitarian design corresponding to an ordinary municipal waterworks stand-pipe.



Nº 2

HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

GENERAL PLAN OF POWER PLANT WITH CONDUIT CONNECTIONS

Toronto, Feb. 20th., 1922. Made by SRW. Checked by LLK.

WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS

(5)

All the surge tanks are located on the natural surface of the rising ground between the top of the cliff and the hillside a short distance landwards.

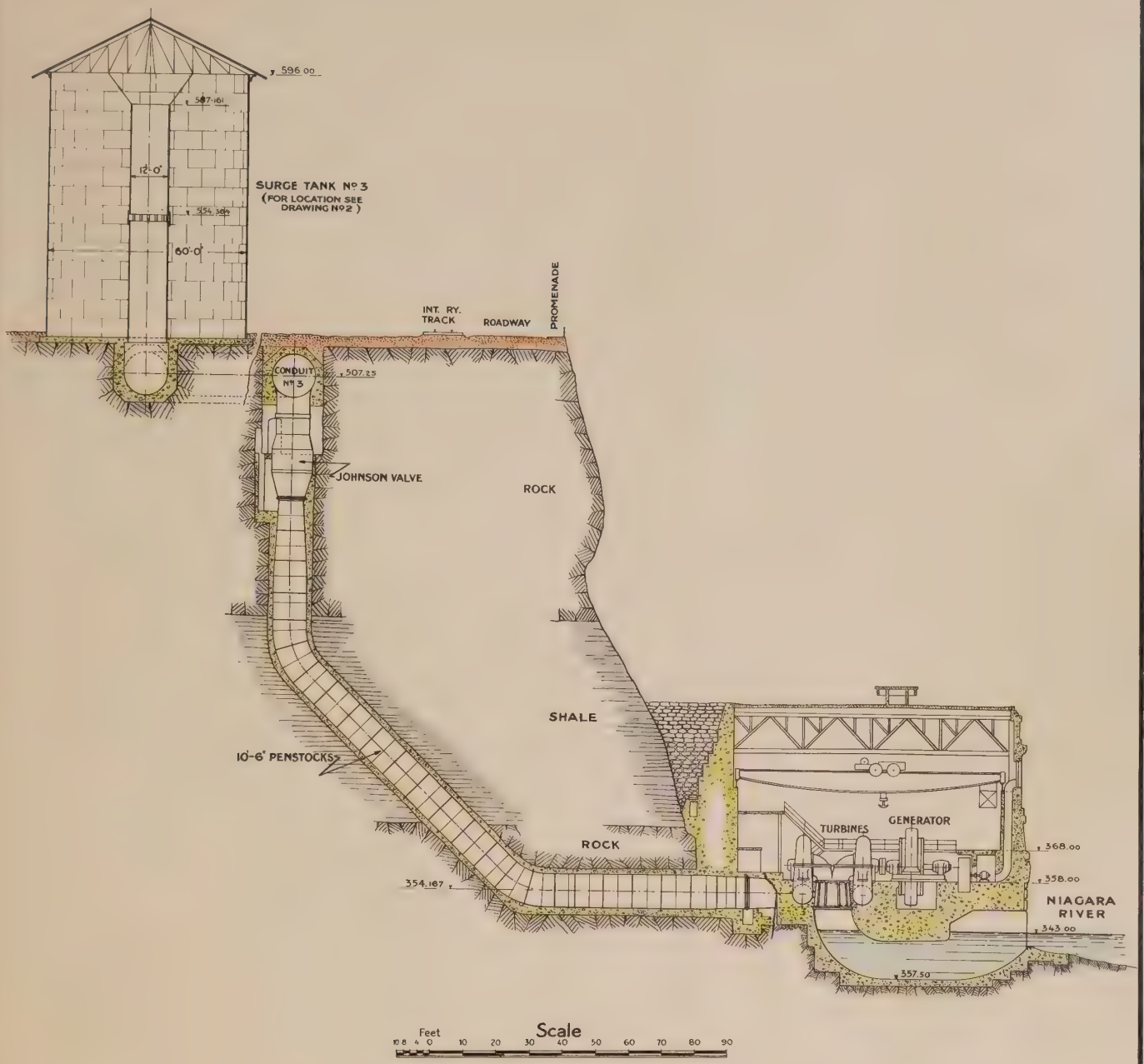
The Penstocks.

Sixteen steel penstocks convey the water from the conduits to the main units in the power house, one penstock for each main unit. The arrangement of the penstocks and their interconnections to the conduits will be seen by reference to Drawing No. 2, a typical section being that of the penstock for main Unit No. 15 as shown on Drawing No. 3 included as page 7 hereof. All the penstocks are of steel embedded in concrete which entirely fills the shaft excavated therefor in the rock. The penstocks for main units Nos. 1 to 12 inclusive are 9 feet in diameter; for main units Nos. 13 and 14, 9 feet 6 inches in diameter; and for Nos. 15 and 16, 10 feet 6 inches in diameter. On each of the penstocks immediately below the conduits there is a controlling valve, that on the penstocks for main units Nos. 1 to 11 being of the gate type and for Nos. 12 to 16 of the Johnson plunger type.

Special penstocks lead from conduit No. 2 to the two-unit exciter plant in the power house independently of the main units.

The Power House.

The power house located at the water's edge at the base of the cliff is about 780 feet in length. It is a fireproof structure built of reinforced



Nº 3

HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

GENERAL CROSS SECTION OF POWER PLANT THROUGH CONDUIT AND POWER HOUSE AT UNITS 15 & 16

Toronto, Feb. 20TH 1922. Made by S.R.W., Checked by L.J.F.

WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS

concrete. The roof trusses are of steel, the roof slab is of reinforced concrete with the exposed surface of the roof finished in tiles.

In the original plant there were fourteen main units in addition to the exciters. Later, main units Nos. 15 and 16 were added. The turbine rating of main units Nos. 1 to 7 is 11,800 horse-power; of Nos. 8 to 12, 15,000 horse-power; and of Nos. 13 and 14, 16,000 horse-power each. The turbine rating of Nos. 15 and 16 is 18,000 horse-power each. All of these units are of the horizontal-shaft type, and the turbine head is about 180 feet. The generators are set with the shafts in the same horizontal plane about 5 feet above the power house floor, and the centre of the rotor of every generator is placed in the same straight line from end to end of the plant.

A two-unit exciter plant is located between main units Nos. 10 and 11.

A gallery on which the governor mechanism is located extends from end to end of the building at an elevation of about 10 feet above the power house floor.

The draft tubes discharge directly over a weir into the river.

The general relation of the various parts will be seen by reference to Drawings Nos. 2 and 3.

The Transformer and Distributing Station.

The transformer and distributing station of the plant is located on top of the hill about 500 feet from the top of the cliff at the rear of the power house. Communication is established between the power house and the transformer station by tunnels and by shafts wherein elevators are installed.

The location of the small entrance building beside the promenade and roadway may be seen on Drawing No. 2, while the general location of the transformer house and distributing station on the hill will be seen by reference to Drawing No. 1.

The distributing station is a fireproof building several stories in height, of ornate design, and situated in grounds beautifully laid out.

The building contains the switching, operating and control apparatus, as well as the high tension equipment.

The Hydro-Electric Power Commission Addition.

During the years 1918 and 1919 the Hydro-Electric Power Commission of Ontario made the last important addition to the plant, consisting of the installation of two complete units in a building which was a continuation of the original power house in a northerly direction, the original northerly wall forming a dividing wall between the older part of the plant and the new. The two new units were designated No. 15 and No. 16, continuing the nomenclature of the original plant so that machine No. 15 was adjacent to the dividing wall, No. 16 occupying the more northerly position. Each of the two new units had a turbine rating of 18,000 horse-power, and was generally similar in type and design to the original units. Both generators were set as before with the rotor in the same line as all the others, but at an elevation 10 feet lower.

The substructure and the walls of the addition were of concrete, and the floors and galleries were of reinforced concrete. The roof slab was

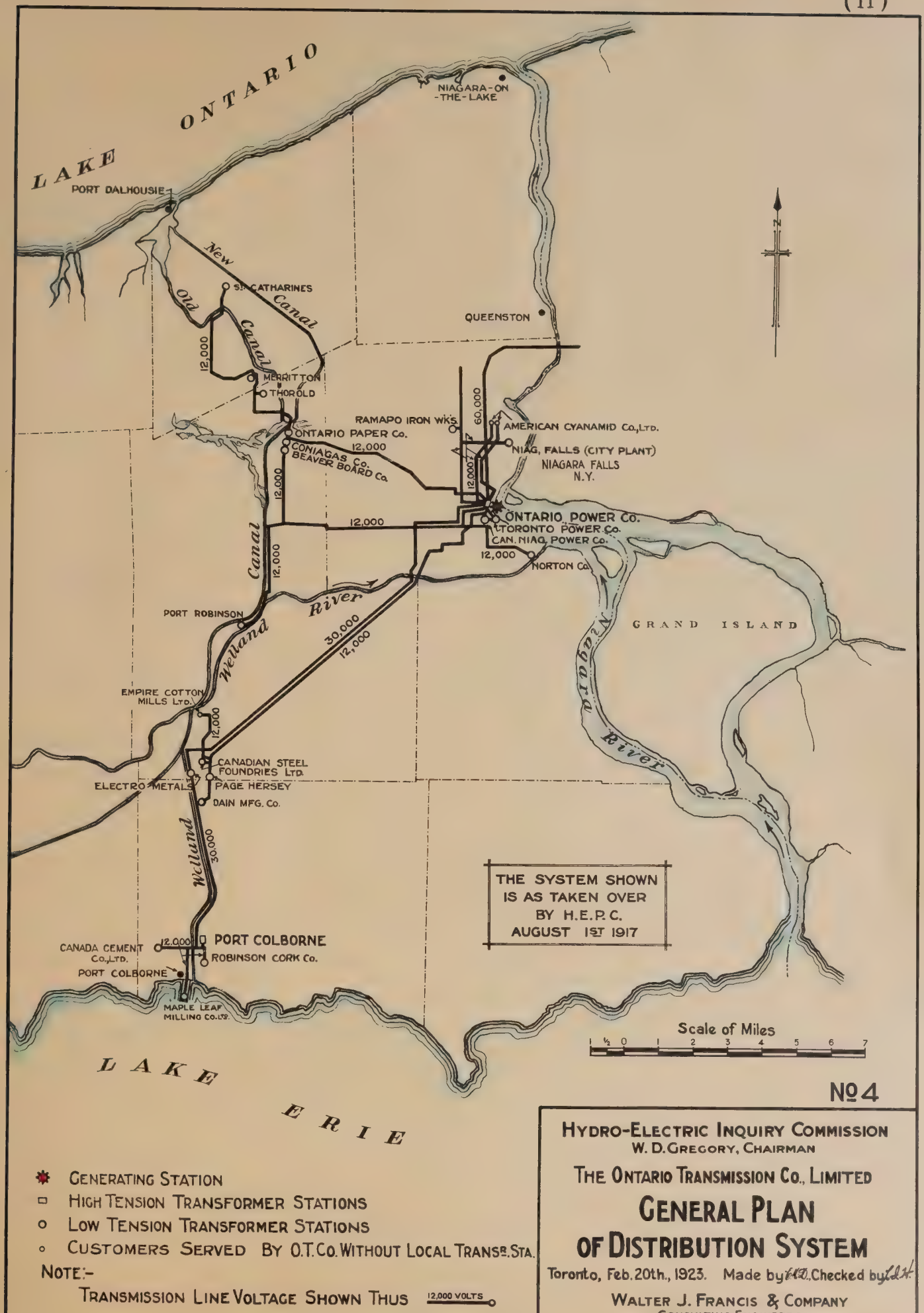
likewise of reinforced concrete, and was supported by steel truss girders.

Unit No. 15 and Unit No. 16 were of the same capacity and were identical in detail. The turbines and the generators were manufactured by the same firms, part by part. The turbine of each unit is a horizontal-shaft, double spiral casing, Francis turbine, and the generator of each unit is an alternating current generator of 15,000 kilovolt-ampere capacity at 75 per cent. power factor and at 12,000 volts.

The turbines were manufactured by the S. Morgan Smith Co. of York, Pennsylvania, and it is understood that they were originally intended for the use of a French Aluminum Corporation, later becoming the property of The Aluminum Company of America. Owing to a change in the proposed plan of development, The Aluminum Company finally decided not to use the turbines, and by mutual arrangement they were accepted for use in the new addition of the plant of The Ontario Power Company of Niagara Falls. The arrangement was concluded in April, 1918, and the turbines were erected during the early part of the year 1919.

The generators were manufactured by the Canadian General Electric Company, Peterborough, Ontario, on a special order for the work under date of January 12th, 1918, and were erected during the first half of the year 1919.

The governors were manufactured by The Lombard Governor Co., Ashland, Massachusetts, and the remainder of the machinery for the addition was supplied by standard makers.



- Generating Station
- High Tension Transformer Stations
- Low Tension Transformer Stations
- Customers Served By O.T.Co. Without Local Transr. Sta.

Note:-

Transmission Line Voltage Shown Thus 12,000 VOLTS

No 4

Hydro-Electric Inquiry Commission
W. D. Gregory, Chairman

The Ontario Transmission Co., Limited

General Plan of Distribution System

Toronto, Feb. 20th., 1923. Made by [illegible] Checked by [illegible]

Walter J. Francis & Company
Consulting Engineers

For the operation of these two units the Hydro-Electric Power Commission provided for an additional conduit, No. 3, of wood-stave construction, to convey the water from the intake works to the plant. This conduit, with its own surge tank and penstocks, provided a supply of water for the new addition independently of the older portion of the plant. Otherwise, all the conditions were similar to those obtaining in the older portion.

The total cost of the addition together with Units Nos. 15 and 16 and the auxiliary plant, and the conduit, surge tanks, and penstocks was $3,514,686.62. The contract price of the two generators complete and ready for service was $350,000.00.

Unit No. 15 commenced operation on June 3rd, 1919, and Unit No. 16 on August 12th, 1919.

The Transmission System.

The distribution system was under the control of a subsidiary company of The Ontario Power Company of Niagara Falls styled The Ontario Transmission Company, Limited.

The map on page 11 shows the district in which the output of the plant was distributed, and it indicates also in a diagrammatic way the location of the transmission lines and the voltage when the system was acquired by the Hydro-Electric Power Commission. The high tension and the low tension sub-stations are also shown thereon.

Analysis of Cost of Hydro-Electric Power Commission Addition.

For convenience of reference a series of four tables is attached hereto, containing an analysis of the cost of the addition made to the plant in 1918 and 1919 by the Hydro-Electric Power Commission. The headings of the various tables are self-explanatory. The references to estimated quantities and costs relate to the estimate made by the Hydro-Electric Power Commission in 1917.

I have studied the circumstances which led up to the construction of the addition, ultimately known as conduit No. 3 and Units 15 and 16, and I have gone over the matter carefully with the engineers of the Hydro-Electric Power Commission, who have furnished me with the figures given in the tables.

The addition as originally conceived involved only the use of the residual capacity of the fourteen installed units of the plant, said to be approximately 25,000 horse-power, susceptible of reclamation by reducing the hydraulic head losses in conduit No. 1 and conduit No. 2. Comprehensively, therefore, this project comprised the installation of a third wood-stave pipe line of comparatively small diameter leading from the available connection at the gate-house and following along the surface contours as far as practicable down to a connection with No. 2 surge tank. This plan would have relieved the abnormal draft on conduit No. 1 and conduit No. 2, thereby increasing the head on the turbines.

While the above project was under investigation, it is stated that the load requirements for munition work became so urgent that the Hydro-Electric Power Commission suddenly decided to purchase two second-hand turbines from

The Aluminum Company of America and also to buy two new generators for connection thereto. This decision resulted in the deletion of the factors which entered into the original intention of the addition, and the whole problem became one of quickly installing a water connection between the headworks and the new turbines with sufficient independent capacity therefor. This involved the building of a wood-stave conduit, and it was decided to adopt a pipe of the same diameter as the largest hitherto built, namely 15' 6". The engineers of the Hydro-Electric Power Commission say that they did not feel justified in advancing beyond the precedent of installing a pipe larger than 15' 6" in diameter, because of the serious damage to Park property which would inevitably result, on account of the large quantity of water involved, if a failure were to occur.

The use of pipe of this size eliminated the possibility of generally using the surface contours, as had been intended for the smaller one, and consequently a larger yardage of excavation was involved. The engineers say, moreover, that there was no time for the making of surveys and borings or for the preparation of detailed plans, and all studies and estimates had to be made on the basis of such data as were available in the original files of the Ontario Power Company. The essential plans for construction and installation purposes had to be issued while the construction work was actually under way.

The size and location of the new wood-stave pipe line, known as No. 3, caused the Queen Victoria Niagara Falls Park Commissioners to require the backfilling of about three thousand lineal feet of the line. The magnitude

of the pipe and its resultant inability to retain its circular form under heavy outside pressure made it necessary to place a concrete envelope around the section to be backfilled before the backfilling was placed.

Under these circumstances it was not possible to determine the relative proportions of earth and rock excavation or the location of such obstructions as duct-lines, water pipes and so forth, or for any of the detailed information concerned in the works for the surge tank and the addition to the power house building. The uncertainty in the matter of rock quantities also of necessity resulted in a similar uncertainty in concrete yardage.

To save time, the approximate weights and dimensions for the steel plate work were figured from the old plans of the Ontario Power Company and tenders were called for on the basis of a flat rate per pound for material to be subsequently estimated and ordered.

Walter J. Francis

Consulting Engineer.

Toronto, March 6th, 1923.

WALTER J. FRANCIS & COMPANY.

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ONTARIO

Addition Made to Plant by

Itemized Cost

Nature of Work	Quantities
Conduit	
Wood Stave Pipe	6,533 Lineal Feet
Excavation, Earth	96,526 Cubic Yards
Excavation, Rock	49,124 Cubic Yards
Concrete, Mass } Concrete, Reinforced }	8,048 Cubic Yards
Backfill	79,809 Cubic Yards
Top Dressing	40,800 Square Yards
Drains	11,239 Lineal Feet
Distributor	
Steel	158.9 Tons
Excavation, Earth	677 Cubic Yards
Excavation, Rock	1,920 Cubic Yards
Concrete, Mass and Reinforced	1,006 Cubic Yards
Backfill	- -
Headworks	- -
Surge Tank Connection	
Excavation, Earth	266 Cubic Yards
Excavation, Rock	1,165 Cubic Yards
Concrete, Mass and Reinforced	499 Cubic Yards
Backfill	- -
Bridges and Culverts	- -
Surge Tank	
Steel	331.3 Tons
Excavation, Earth	593 Cubic Yards
Excavation, Rock	763 Cubic Yards
Concrete, Mass and Reinforced	161 Cubic Yards
Brickwork	5 Cubic Yards
Backfill	- -
Valve Chamber	
Steel	34.3 Tons
Johnson Valves	4
Excavation, Rock	812 Cubic Yards
Concrete, Mass and Reinforced	698 Cubic Yards
Floors, Concrete	1,261 Square Feet

POWER COMPANY

Hydro-Electric Power Commission

of Addition

Direct Costs	Indirect Costs	Total	Unit Costs
$428,130.83	$40,308.70	$468,439.53	$71.70 per Foot
80,472.45	31,834.00	112,306.45	1.16 per Cubic Yard
138,066.59	54,612.00	192,678.59	3.92 per Cubic Yard
147,532.70	56,318.00	203,850.70	25.32 per Cubic Yard
103,610.39	40,969.00	144,579.39	1.80 per Cubic Yard
4,071.30	1,620.00	5,691.30	.50 per Foot
52,780.91	5,215.00	57,995.91	365.00 per Ton
1,367.64	560.00	1,927.64	2.85 per Cubic Yard
5,780.81	2,300.00	8,080.81	4.21 per Cubic Yard
25,027.84	9,885.00	34,912.84	34.70 per Cubic Yard
4,163.17	1,660.00	5,823.17	-
10,310.56	4,000.00	14,310.56	-
262.27	120.00	382.27	1.44 per Cubic Yard
7,962.31	3,170.00	11,132.31	9.39 per Cubic Yard
11,682.90	4,630.00	16,312.90	32.69 per Cubic Yard
154.95	80.00	234.95	-
2,506.98	1,100.00	3,606.93	-
54,106.05	5,335.00	59,441.05	179.41 per Ton
1,439.95	550.00	1,989.95	3.35 per Cubic Yard
3,847.28	1,500.00	5,347.28	7.01 per Cubic Yard
2,547.15	990.00	3,537.15	21.97 per Cubic Yard
179.40	80.00	259.40	51.88 per Cubic Yard
2,328.29	910.00	3,238.29	-
5,623.23	2,220.00	7,843.23	228.66 per Ton
139,501.65	11,035.00	150,536.65	37,634.16 Each
9,472.19	3,760.00	13,232.19	16.29 per Cubic Yard
14,642.89	5,765.00	20,407.89	29.24 per Cubic Yard

WALTER J. FRANCIS & COMPANY.

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Addition Made to Plant b

Itemized Cost o

Nature of Work	Quantities
Penstocks	
Steel	310.5 Tons
Excavation, Rock	2,756 Cubic Yards
Concrete, Mass and Reinforced	1,725 Cubic Yards
Drains	- -
Power House Substructure	
Excavation, Rock	29,824 Cubic Yards
Concrete	5,892 Cubic Yards
Backfill	2,718 Cubic Yards
Power House Superstructure	
Concrete	2,475 Cubic Yards
Floors, Concrete	5,870 Square Feet
Steelwork	146.5 Tons
Miscellaneous, Roofing, etc.	- -
Turbines and Governor	2
Water Supply and Drainage	
Heating and Ventilating	
Oil Supply	
Compressed Air Supply	
Generators and Electrical Equipment	
Mechanical Equipment	

POWER COMPANY

Hydro-Electric Power Commission

Addition (continued)

Direct Costs	Indirect Costs	Total	Unit Costs
$ 80,970.04	$ 7,985.00	$ 88,955.04	$286.67 per Ton
7,979.34	3,170.00	11,149.34	4.05 per Cubic Yard
33,162.89	13,135.00	46,297.89	26.84 per Cubic Yard
7,569.73	3,010.00	10,599.73	-
94,823.87	36,389.00	131,212.87	4.48 per Cubic Yard
177,508.71	70,183.00	247,691.71	42.04 per Cubic Yard
9,546.81	3,760.00	13,306.81	4.89 per Cubic Yard
79,450.00	31,444.00	110,894.00	44.80 per Cubic Yard
24,687.10	4,870.00	29,557.10	201.75 per Ton
20,802.92	6,165.00	26,967.92	-
176,255.36	9,965.00	186,220.36	-
21,971.84	4,360.00	26,331.84	
1,780.75	360.00	2,140.75	
4,868.21	950.00	5,818.21	
454.40	80.00	534.40	
565,847.48	27,954.00	593,801.48	
11,758.87	1,190.00	12,948.87	
$2,577,033.00	$515,496.70	$3,092,529.70	

ONTARIO POWER COMPANY

Addition Made to Plant by Hydro-Electric Power Commission

Summary of Indirect Costs, Special Charges and so forth

Indirect Costs		
Construction Plant and Machinery	$87,607.47	
Construction Railways	57,637.00	
Construction Roadways	12,196.92	
Construction Power, Light and Telephone ..	54,050.45	
Construction Water and Sanitary Systems ..	15,910.73	
Construction Compressed Air Systems	29,701.20	
Construction Plant Maintenance	113,381.29	
Auxiliary Plant Operation	142,342.74	
Tests and Inspection	3,036.24	$515,864.04
Temporary Buildings - Credit $367.34		367.34
Total		$515,496.70
Special Charges		
Expenses Securing Labour	2,009.83	
Police Protection	43,720.56	$45,730.39
Field Engineering and Superintendence	69,780.97	
Head Office Engineering and Superintendence		
Hydraulic	38,774.01	
Electrical	22,467.19	61,241.20
Administration including Interest during construction	240,825.71	

WALTER J. FRANCIS & COMPANY.

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ONTAR

Addition Made to Plant

Comparison of Estimat

Nature of Work	Unit	Estimated Figures Quantities	Total Costs	Uni Cost
Wood Stave Pipe and Saddles ..	Lineal Feet	6,500	$346,000.00	$ 53.
Excavation, Earth)	Cubic Yards			
Excavation, Rock)	Cubic Yards	150,000	105,000.00	.
Backfill)	Cubic Yards			
Top Dressing)	Square Yards			
Concrete	Cubic Yards			
Drains	Lineal Feet			
Distributor				
Steel	Tons	133	23,940.00	180.
Excavation, Earth	Cubic Yards			
Excavation, Rock	Cubic Yards			
Backfill	Cubic Yards			
Concrete	Cubic Yards			
Surge Tank				
Steel	Tons	297.5	49,580.00	166.
Excavation, Earth	Cubic Yards			
Excavation, Rock	Cubic Yards			
Backfill	Cubic Yards			
Brickwork	Cubic Yards			
Concrete	Cubic Yards			
Surge Tank Connection				
Excavation, Earth	Cubic Yards			
Excavation, Rock	Cubic Yards			
Backfill	Cubic Yards			
Concrete	Cubic Yards			
Johnson Valves		4	130,000.00	32,500.
Valve Chamber				
Steel)	Tons	No	25,000.00	.....
Excavation, Rock)	Cubic Yards	Quantities		.....
Concrete)	Cubic Yards	Estimated		.....
Penstocks				
Steel	Tons	201	36,180.00	180.
Excavation, Rock	Cubic Yards	1,900	21,000.00	11.
Concrete	Cubic Yards	1,100	14,500.00	13.
Drains				

POWER COMPANY

Hydro-Electric Power Commission

and Actual Costs

Actual Cost of Items Estimated			Actual Cost of Items Not Estimated			Remarks
Quantities	Total Costs	Unit Costs	Quantities	Total Costs	Unit Costs	
6,533	$468,439.53	$ 71.70				Figures shown include cost of saddles.
96,526	112,306.45	1.16				
49,124	192,676.59	3.92				
			79,809)	$144,579.39	$ 1.80	
			40,800)			
			6,048	208,850.70	25.32	
			11,239	5,691.80	0.50	
156.9	57,995.91	365.00				
			677	1,927.64	2.85	
			1,920	8,080.61	4.21	
			-	5,823.17	-	
			1,006	34,912.84	34.70	
331.3	59,441.05	179.41				
			593	1,989.95	3.35	
			765	5,347.28	7.01	
			-	3,238.29	-	
			5	259.40	51.88	
			161	3,537.15	21.97	
			266	382.27	1.44	
			1,185	11,132.31	9.39	
			-	234.95	-	
			499	16,512.90	32.69	
4	150,836.65	37,634.16				
34.3	7,843.23	228.66				
812	13,232.19	16.29				
698	20,407.89	29.24				Includes concrete floors.
310.3	88,955.04	286.67				
2,756	11,149.34	4.05				
1,725	46,297.89	26.84				
			-	10,599.73	-	

WALTER J. FRANCIS & COMPANY.

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CONTRACT

Addition Made to Plant I

Comparison of Estimate

Nature of Work	Unit	Estimated Figures Quantities	Total Costs	Unit Costs
Power House Substructure Excavation, Rock ..... Cubic Yards ..... Backfill ..... Cubic Yards ..... Concrete ..... Cubic Yards		-	$124,000.00	
Turbines, Governors, etc.		2	170,000.00	$85,000.00
Bridges, Line Crossing, etc.		-	10,000.00	-
Drainage		-	5,000.00	-
Headworks				
Water Supply and Drainage				
Superstructure Steelwork ..... Tons ..... Concrete ..... Cubic Yards ..... Miscellaneous, Roofing, etc.		-	100,000.00	-
Generators and Electrical Equipment		2	536,172.00	268,086.00
Mechanical Equipment				
Heating, Lighting, Ventilating, Oil Supply and Compressed Air		-	14,040.00	-
			$1,710,212.00	
Engineering			105,021.00	.....
Special War Protection				
Administration and Interest less Unclaimed Wages				
			Estimated $1,815,233.00	

added to 1.815.000.

POWER COMPANY

Hydro-Electric Power Commission
and Actual Costs (continued)

Actual Cost of Items Estimated			Actual Cost of Items Not Estimated			Remarks
Quantities	Total Costs	Unit Costs	Quantities	Total Costs	Unit Costs	
29,824	$131,212.87	$ 4.40	.....			
2,718	13,306.81	4.89	.....			
5,892	247,691.71	42.04	.....			
2	186,220.36	93,110.18	.....			
-	3,606.93	-	.....			
See figures for Drains under various headings.						
.....		-		14,310.56	-	No quantities given.
.....		-		26,331.84	-	
146.5	29,557.10	201.75	.....			Includes
2,475	110,894.00	44.80	.....			Floors and
-	26,967.92	-	.....			Roof.
2	593,801.46	296,900.74	.....			
.....		-		12,948.87	-	
-	8,493.36	-	.....			
	$2,561,038.30			$511,491.35		
		$3,092,529.65				
.....	131,022.17	.....				
.....				45,730.39		
.....				240,039.74		
	$2,712,060.47			$797,261.48		
		Actual cost $3,509,321.95				

ONTARIO POWER COMPANY

Addition Made to Plant by Hydro-Electric Power Commission

Increase of Costs Due to Increase of Quantities on Basis of Actual Unit Costs

Nature of Work	Estimated Quantities	Actual Quantity	Difference	Unit Cost	Amount
Conduit					
Wood Stave Pipe ...	6,500 Lin.Ft.	6,533	33	$71.70	$ 2,366.10
Excavation, Earth .	150,000 Cu.Yds.	96,526	Cr.53,474	1.16	Cr. 62,029.84
Excavation, Rock ..	-	49,124	49,124	3.92	192,566.08
Distributor					
Steel	133 Tons	158.9	25.9	365.00	9,453.50
Surge Tank					
Steel	297.5 Tons	331.3	33.8	179.41	6,064.06
Penstocks					
Steel	201 Tons	310.3	109.3	286.67	31,333.03
Excavation, Rock ..	1,900 Cu.Yds.	2,756	856	4.05	3,466.80
Concrete	1,100 Cu.Yds.	1,725	625	26.84	16,775.00
Substructure*					
Excavation, Rock* .	24,000 Cu.Yds.	29,824	5,824	4.48	26,091.52
Concrete*	2,600 Cu.Yds.	5,892	3,292	42.04	138,398.68
Backfill*	-	2,718	2,718	4.89	13,291.02
					$377,772.95

* Estimated quantities for Substructure assumed as under, to amount to $124,000.00

Excavation, Rock ..	24,000 Cu.Yds.	at $3.00	=	$72,000.00
Concrete	2,600 Cu.Yds.	at 20.00	=	52,000.00
Backfill	- - - -			-
				$124,000.00